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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

Agenda Item: D.12.1

United Kingdom

THE IMPLEMENTATION OF PLANS FOR THE DEVELOPMENT OF THE CHEMICAL INDUSTRY

By D.C. LENNON, Director,
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London

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The Implementation of Plans for the Development of the Chemical Industry

by D.C. Lennen, Director, Humphreys & Glasgow Limited, London

1. To the people of the underdeveloped countries the establishment of a chemical industry represents making available many of those products and services which are already an essential part of the life of more privileged countries. Plastics, man-made fibres, paints, suface coatings, fertilisers, insecticides, pharmaceuticals, detergents, inorganic and organic chemicals - the range of products of the chemical industry is now immense and permeates every phase of our daily lives.

2. Looking at the benefits which a developed chemical industry can provide, the underdeveloped country may take a decision in principle to further the establishment of its own chemical industry. But how is such a decision to be put into effect ?

3. Scarcity of technical personnel in the underdeveloped countires, and even in the entire world, familiar with the complex technical considerations in the rational and economic choice of plants over the whole field of the chemical industry immediately presents a severe restriction. Economic factors are obviously of the highest importance. To operate profitably, modern chemical plants must in general be large. The purchasing power per capita in many of the underdeveloped countries is low and careful attention must be given to the problem of determining how the production may be absorbed. Nor must it be forgotten in this connection that considerable extra investment is required in subsidiary industries for dealing with the finished products from the chemical industry. In the plastics industry for example, may be cited the film making, extrusion and moulding machinery necessary for converting plastics into saleable articles. Finally, the social impact of a chemical industry must be examined. However, there is no doubt that chemical plants which represent an intense concentration of capital and technical skill cannot act otherwise than as foci for the development of technical and managerial skills with resulting benefit to the country as a whole.

4. A country without any chemical industry whatsoever is rare. But in a country where only a few chemical plants exist, these have usually been built as a result of local considerations without relation to the national economy as a whole. This paper begins from the point of view of a country with a limited chemical industry and the suggested steps which may be followed towards the creation of a chemical industry. It attempts to outline the factors which are of importance in considering the problem as a whole. Some of the latter considerations may be of interest to those countries which have already reached an advanced stage in the planning of their chemical industry. This paper therefore begins with a suggested type of initial survey which can be carried out as a first step in implementing a decision to develop a chemical industry.

5. The purpose of the initial survey should be to establish the outlines of the most economic and beneficial future pattern which a chemical industry could follow. Before such a survey can be effectively undertaken, certain basic information must be made available in as much detail as possible. This information may be briefly summarized as follows :

(a) Meteorological conditions :

i) Rainfall statistics.
ii) Temperature statistics.
iii) Wind conditions.

(b) Hydrological survey :

(i) Main rivers - monthly flow - temperature conditions, and purity of water
(ii) Other water sources

(c) Topographical information

(d) Transport facilities :

(i) Ports - location - tonnage handled - lifting facilities
(ii) Railways - location - load capacity - cost of transport per ton/mile
(iii) Roads - location - cost of transport per ton/mile

(e) Consumption of chemicals

(f) Existing chemical plants :

(i) Location and type
(ii) Products - quality and quantity
(iii) Raw materials

(g) Existing industrial plants :

(i) Location and type
(ii) Products - quality and quantity
(iii) Raw materials

(h) Geological conditions :

(i) Mineral deposits
(ii) Coal deposits
(iii) Oil or natural gas fields

(j) Existing electrical power system

(k) Customs dues and regulations

(l) Fiscal policy

(m) Internal costs, such as :

(i) Wage rates
(ii) Cost of common products, e.g. gasoline, fuel oil, etc.

6. As part of their development programmes, most countries have already set up departments or institutes in the meteorological, hydrological and geological fields. Turkey is an example where information of this type is particularly well documented. Information on transport facilities is, as a rule, readily available. Again, information on the existing electrical power system, customs dues and regulations, and fiscal policy can be obtained from the respective Ministries.

7. For the following categories : existing chemical plants, existing industrial plants, and consumption of chemicals, it is often more difficult to obtain precise information. Customs' statistics are generally unreliable sources of the consumption of chemicals because of the grouping of certain classes of chemicals and re-exports. The best guide is often direct contact with the existing industries themselves, which can be carried out in conjunction with the initial survey. In such a way a more realistic estimate of present and future consumption can be made and the initial survey can use the experience, even if limited, of the organizations already operating.

8. Notwithstanding the aims of the survey itself, the ready availability and careful documentation of the information of the categories listed above is an important factor in establishing confidence with private companies which will later consider establishing plants in the country.

9. There is a wide choice of organizations capable of carrying out such a study. However, under present-day conditions, one important factor must be taken into account. The chemical processes developed by the chemical companies are either licensed directly to other chemical companies or through the international chemical engineering contractors. It is only these latter organisations, together with the chemical companies themselves that have reliable technical and financial data over the whole field of the chemical industry. Many published data exist, but again the sifting of the accurate from the erroneous information demands a wide background of experience. Apart from these companies, only Government or International Agencies may, in general, succeed in obtaining the necessary access to the experience and jealously guarded know-how of the chemical companies. This problem is a particularly stringent restriction on the activities of consulting firms and only the largest can hope to be in possession of the necessary facts for carrying out a survey of this type. A representative, but not necessarily complete, list of possible organizations is given in Table 1, with, in some cases, references to studies which have been carried out.

10. The cost of the initial survey should be approximately $5,000 to $40,000 and require that up to four technical experts visit the country for a period of one to four months. Following the visit, the compilation of the data and preparation of the report could last a further two to three months. Various International and Government Agencies will, in certain circumstances, offer financial assistance under their technical aid programmes towards carrying out this type of survey.

11. The final report should have basically the following contents :

(a) General survey of the country recording any particular difficulties;
(b) Market assessment of present and future chemical needs;
(c) Recommendations on the type of chemical plants which could be established, and suggested locations;
(d) Capital and operating costs for the plants proposed (a typical example is provided in Table 2);
(e) Recommendations on the programme for establishing the plants;
(f) Summary of basic data.

12. On the basis of the initial survey, the Government may decide the allocation of possible chemical projects to the public or private sectors. The wide circulation of initial survey among the international chemical companies and local investors can focus their attention on the investment possibilities. Together with the initial survey, information may be distributed on any financial incentives that the Government may wish to institute to further the attractiveness of the private companies' investment. Such incentives may be :

(a) Period of tax exemption;
(b) Rapid amortization of plant;

(c) Waiving import duty on the imported plant and equipment;
(d) Free transfer of profits and capital.

13. To handle the complex problems of implementing a programme for the development of chemical industry both in the private and public sectors, an efficient Government organisation is necessary. This organisation should have broad powers to cover :

(a) Research and development;
(b) Project studies;
(c) Promotion of the chemical industry;
(d) Preparation of invitations to tender for chemical plants in the public sector and their subsequent technical and commercial evaluation;
(e) Recommendations to the Government on price policy, tax considerations, etc., in relation to the chemical industry.

14. This paper is too short to contain a detailed examination of such an organisation. Advice may be obtained from many of the bodies listed in Table 1. Certain of these organisations, such as the Institut Francais du Petrole, have already developed programmes for assisting other countries in the establishment of institutes covering the technical aspects of the problem which could be later expanded to cover the above-mentioned requirements.

15. Before considering the next phase of the detailed survey and the subsequent preparation of invitations to tender, some understanding is necessary of the broad cost components of a chemical plant and their influence on the form of tender and the subsequent work. The cost of a chemical plant may be divided under the following headings :

(a) Royalty or licence fee;
(b) Engineering and drafting;
(c) Equipment and material;
(d) Transport of equipment and material to site;
(e) Erection labour, together with hire-purchase of construction equipment and contractor's supervision.

16. Table 4 shows the percentage breakdown of cost under these headings for a large nitrogenous fertiliser plant. Variations in these percentages naturally occur for different types of plant, but the order of magnitude in general remains the same, apart from plants of a capital investment of less than $500,000.

17. To a person unfamiliar with the industry, the percentage cost of engineering and drafting may appear high. However, each large chemical plant is unique and must be designed afresh in accordance with the overall and local conditions which are imposed. The preparation of the detailed drawings for each item of equipment and the piping connected with it, the engineering specifications, and the process calculations can involve an expenditure of from 10,000 to 250,000 man-hours, depending on the size of the plant.

18. In the programming of the plants to be built it must be taken into account that as a yardstick approximately two years are required to put into operation a large chemical plant, from the date of signature of the contract. Careful analysis must be made of the financial obligations throughout the design and construction period and also of the delivery and construction requirements in relation to transport and port facilities, availability of construction labour, etc. The graph of Table 5 shows the ideal progress of a project in terms of :

(a) Material and equipment commitment;
(b) Engineering and drafting man-hours;
(c) Construction man-hours.

19. In deciding the form of purchase of the plants, the customer has three main choices. These are shown in Table 3.

20. Purchasers in the West of considerable experience, such as the large oil and chemical companies, often choose the first alternative. The contractor can estimate his price generally within one month, and work can proceed immediately. Knowing the prevailing costs and being thoroughly familiar with the technical aspects of the work, the purchaser has considerable flexibility in altering the contractual or technical conditions.

21. The other countries of the World generally stipulate contracts of the form of Alternative II or III. For Alternative III, the preparation of the tender may require from two to six months. The investigation of the local conditions regarding the erection must be carried out in great detail since, as we have seen, the price component of Table 3, Erection Labour, etc., may be of the order of 25% of the total cost.

22. When the overall programme for the establishment of chemical plants has been agreed, the Government organization previously referred to may proceed to the detailed studies necessary to determine the basis on which these plants may be built. In the event that the technical resources of the Government organization are not sufficient to carry out these detailed studies, recourse may be made to the engineering contractors listed in Table I.

23. In using an engineering contractor, it may be expected that the detailed evaluation of one large chemical plant may cost from 1/8th to 1% of the erected capital cost. The detailed evaluation should make recommendations on the following points :

(a) The most suitable process according to the conditions;
(b) The most suitable location of the plant;
(c) The total capital and operating costs of the erected plant;
(d) The marketing of the products;
(e) The suitable contracting companies to which the invitation to tender should be issued.

24. Together with these recommendations, the detailed survey should re-compile all the essential information previously indicated under the initial survey in order that the contractor who submits the tender may have all the relevant information at his disposal. Following this work, preparation of invitations totender may be instituted. The main headings under the invitation to tender may be listed as :

(a) Technical specifications;
(b) Contractual conditions;
(c) Credit conditions.

25. After a detailed evaluation of a particular plant as suggested, there should be little difficulty in drawing up a suitable technical specification. However, care should be taken to see that the specification is as complete as possible in that most underdeveloped countries will select Alternative II or III of Table 3, in order to have a fixed definition of the cost and technical scope of the plant and to facilitate the comparison of the bids received. For this reason, the battery limits and scope of supply of the contractor must be carefully stipulated.

26. The requirements of the contractual conditions vary widely from one country to another. Theoretical and severe contractual conditions are liable to increase the cost of a chemical plant in order to enable the contractor to cover any unforeseen losses he may expect owing to their application. Much difficulty would be avoided if countries would use as a framework of their contractual conditions those established by The United Nations, which provide a fair basis for both parties.

27. The terms of credit are of great importance for many underdeveloped countries. A distinction should be drawn here between Government or semi-Government credit organizations, such as the Export-Import Bank, and the more normal credit terms insured by Government organizations, such as those offered by countries which are signatories to the Berne Convention. The terms offered by the Export-Import Bank, or similar institutions, are in general the most favourable which can be obtained. In the case of countries which are signatories to the Berne Convention, credit terms are normally limited to 10% on order, 10% on shipment, and 80% in five years from the mean date of shipment. Under these terms, considering normal tax and amortization arrangements, the capital involved is not paid off until six or seven years from the date of signature of the contract. Furthermore, a difficulty arises that these terms do not normally provide for any credit facilities for the local expenditure as under Alternative II of Table 3. Great assistance could be given by the more developed countries by reducing the payments required before the start-up of the plant and also by financing the local expenditure involved in the construction and other services which are required. While other credit terms offered may appear attractive, it should be noted that, if the contractor is required to make substantial modifications to the credit terms authorized under Government policy the cost of the credit may increase very steeply. This must be carefully evaluated against the benefits which such credit terms may provide.

28. The selection of the contractors who will be invited to tender must be made in accordance with the detailed evaluation which has been carried out taking into consideration the various contractors' ability on the basis of their technical experience and record in completing successfully a plant of the type which is required. As the bidding costs are high, it is equitable to make an initial selection of , say, between four to six experienced contractors, rather than to ask for free international competition. International competition may result in certain highly competent contractors refusing to quote because they consider their bidding expenses are not justified in relation to the probability of obtaining the contract. When the bids have been received, the evaluation of the respective technical and commercial merits of each bid is highly complicated. As the country concerned will probably have chosen either an Alternative of II or III, approximately as much work is required in the evaluation of the bid as in its preparation by the contractor. However, preliminary economic evaluation can be rapidly made in the following terms :

(a) Capacity, yield and purity of products;
(b) Capital cost of the plant;
(c) Utilities consumption;
(d) Delivery period.

29. Many of the Socialist countries insist that the tender includes a break-down of the price of equipment, together with the weights of each class of equipment. The weights of equipment can be used to determine immediately whether the contractors are bidding on approximately the same basis and further, can be used to check the rough price : weight ratios, to determine whether these fall within the range of world market prices. This procedure might be usefully followed by many underdeveloped countries.

30. Nothing would benefit and accelerate the evolution of the underdeveloped countries more than the establishment - where conditions permit - of chemical plants. Industry and agriculture, as well as the whole social and economic fabric of the country in general, can then reap the immense advantages which the chemical industry has to offer now and in the future.

TABLE I

1. International Organizations:

   (a) United Nations - Technical Assistance Administration [a]
   (b) Food and Agricultural Organization (F.A.O.) - Rome, Italy (restricted to fertiliser plants and agricultural chemicals)

2. Government Organizations:

   (a) Department of Scientific and Industrial Research (D.S.I.R.) - United Kingdom.
   (b) Office National Industriel de l'Azote (O.N.I.A.) - Toulouse, France (restricted to fertiliser plants).
   (c) Institut Francais du Petrole (I.F.P.) - Paris, France *.
   (d) Ente Nazionale Idrocarburi (E.N.I.) - Rome, Italy *.
   (e) National Research Council, Washington, U.S.A. [b] *.
   (f) The various Ministries of Chemical Industry, or associated agencies, of the Socialist countries, e.g. Limex Aussenhandelsgesellschaft mbH, German Democratic Republic.
   (g) Ministerio de Minas e Hidrocarburos - Instituo Venezolano de Petroquimica - Caracas, Venezuela.

   * The activities of these organizations cover the chemical as well as the petroleum industry.

3. International Oil and Chemical Companies:

   These are omitted as being well-known.

4. International Chemical Engineering Contractors:

   (a) United Kingdom

   (i) Humphreys & Glasgow Limited - London.
   (ii) The Power-Gas Corporation Limited, Stockton-on-Tees.
   (iii) Simon-Carves Limited, Stockport.

   (b) France

   (i) Technip (associated with Institut Francais du Petrole), Montrouge
   (ii) Societe de Construction d'Appareils pour Gaz a l'Eau Industriels (SEGI) Paris.

   (c) Italy

   (i) Compagnia Technica Industrie Petroli SpA (C.T.I.P.) - Rome.
   (ii) Societa Montecatini, Settore Progetti e Studi - Milan.
   (iii) SNAM Progetti - Milan (wholly owned subsidiary of Ente Nazionale Idrocarburi, Rome)

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a] Krijgsman, W. Technical Assistance Committee of the United Nations, Los Proyectos de Industria Petroquimica y Carboquimica en Chile, 15th March 1958

b] Academy of Sciences/National Research Council, Washington, D.C., Contract SCC 21718, Utilization of Waste Gases in Saudia Arabia, 14th July 1954.

(d) Federal Republic of Germany

(i) Lurgi Gesellschaft fur Warmetechnik mbH - Frankfurt.
(ii) Hoechst - Uhde International.
(iii) Platsch-Banag A.G., Butzbach/Hessen.
(iv) Hans J. Zimmer - Frankfurt.

(e) United States of America

(i) C.F. Braun & Company Limited, Alhambra, California.
(ii) Bechtel Corporation, San Francisco.
(iii) Foster Wheeler Corporation, New York.
(iv) Lummus Corporation, New York.
(v) M.W. Kellogg, New York.
(vi) Scientific Design Co. Inc., New York.
(vii) Stone & Webster Corporation, Boston.

(f) Belgium

(i) Union Chimique Belge S.A. - Brussels.

(g) Holland

(i) Stamicarbon N.V. - Geleen.

5. International Consultancy Firms :

(a) Arthur D. Little, Inc., Cambridge, Mass., U.S.A. [c]

TABLE 2

Cost of Production of Polyester Resins [d] 450 tons/year

1. Variable Costs		Costs in Chilean Pesos
a) Raw Materials		
Maleic anhydride	200 tons at 760 pesos/ton	152,000
Ethylene glycol	140 tons at 487 pesos/ton	70,000
Styrene monomer	150 tons at 350 pesos/ton	52,000
b) Utilities		
Carbon dioxide		300
Electricity	at 0.017 pesos/KWH	1,700
Steam	at 2.6 pesos/ton	300
Water	at 0.0122 pesos/m^3	700
Operating Labour	3 men/shift at 0.5 pesos/hour	12,000
Maintenance	2%	1,300
		290,800

c Little Inc., Arthur D. A Program for the Industrial and Regional Development of Peru. Report to the Government of Peru. 30th December 1960.

d Delorme, Jean, Technical Assistance Committee of the United Nations, Promocion de la Industria de Materias en Chile, 14 July 1961

2. Fixed Costs

Amortization :	equipment 10% of 53,000 pesos	5,300
	buildings 5% of 12,000 pesos	600
Indirect costs		7,000
Taxes, etc.		1,300
General costs		2,000
Interest at 10% on capital employed		5,500
		21,700
Total cost of producing 450 tons/year		313,500
Production cost/kg.	0.70 Pesos	

TABLE 3

		Alternative I Fixed Engineering Fee	Alternative II Engineering and Materials fob	Alternative III Turnkey
1.	Royalty or Licence Fee	Fixed	Fixed	Fixed
2.	Engineering and drafting	Fixed	Fixed	Fixed
3.	Equipment and material	Direct costs plus agreed percentage paid by client	Fixed	Fixed
4.	Transport of equipment and material to site	Costs paid by client	Costs paid by client	Fixed
5.	Erection labour together with hire/purchase of construction equipment and contractor's supervision	All costs paid by client. Weekly charge for contractor's supervising personnel	All costs paid by client. Weekly charge for contractor's supervising personnel	Fixed
		1 + 2 Fixed price 3 + 4 + 5 Variable as incurred	1 + 2 + 3 Fixed price 4 + 5 Variable as incurred	1 + 2 + 3 + 4 + 5 Fixed price

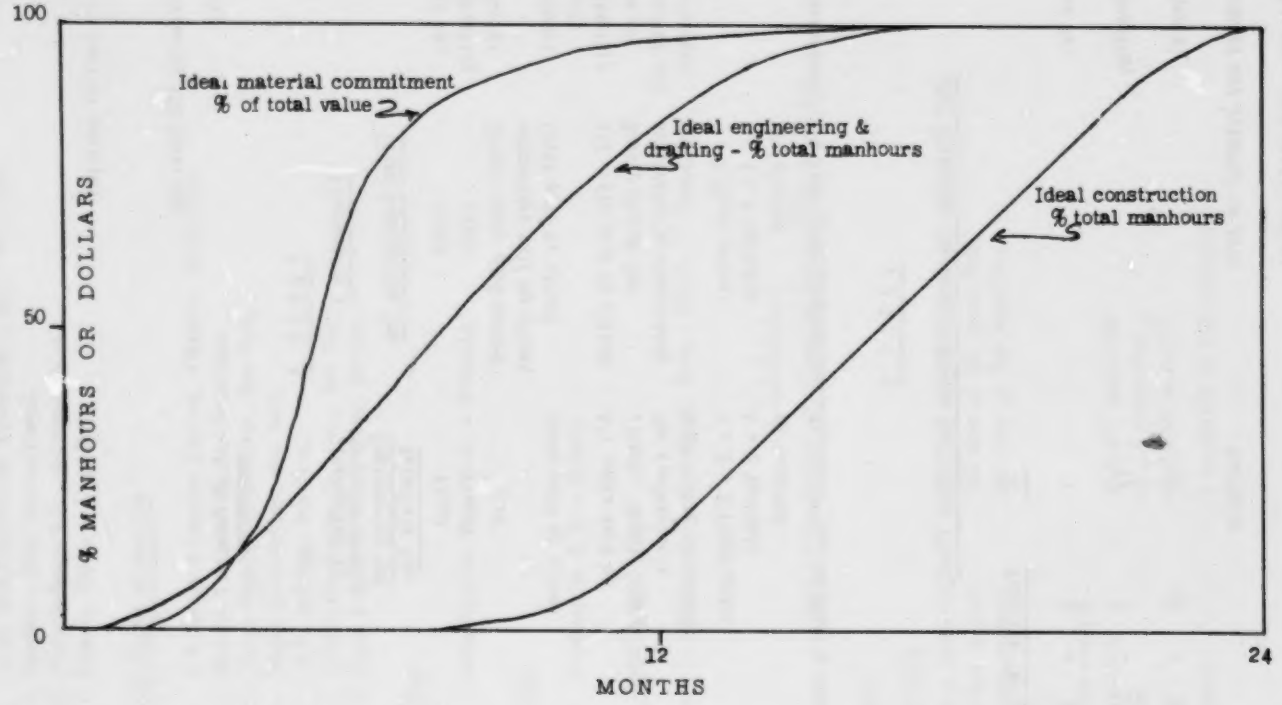
These are the main alternatives. Various other combinations can, of course, be readily seen.

TABLE 4

Cost Breakdown for Large Nitrogen Fertiliser Plant

		%	Possible Variations %
1.	Royalty or Licence Fee	1	0 - 5
2.	Engineering and Drafting	13	7 - 20
3.	Equipment and Material	61	45 - 70
4.	Transport of equipment and material to site	Variable	
5.	Erection labour together with hire/purchase of construction equipment and contractor's supervision	25	15 - 30
	Total erected cost ready for operation	$14,000,000	

TABLE 5



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The Implementation of Plans for the Development of the Chemical Industry

by D. C. Lennon, Director, Humphreys & Glasgow Ltd, London

The paper discusses the steps which an underdeveloped country might pursue towards the establishment of a chemical industry; the type of initial survey which can be made, together with the information which is required for such a survey; and the results which can be expected. Reference is made to the organizations which are capable of satisfactorily completing a survey of this type.

Following the initial survey the Government organization required to implement its recommendations is discussed, together with the incentives which may be offered to private chemical companies to further the development of the chemical industry in the private sector.

The typical cost components of chemical plants are shown, together with the information on programming of the engineering and construction and the financial commitments throughout the work.

The preparation of the invitations to tender, the contractual and credit conditions which apply are briefly reviewed, together with the final evaluation of the tenders when they are received.

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Agenda Item: D.7.1

Czechoslovakia

FACTORS INFLUENCING THE SETTING UP AND DEVELOPMENT OF THE IRON AND STEEL INDUSTRY IN THE LESS DEVELOPED COUNTRIES

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FACTORS INFLUENCING THE SETTING UP AND DEVELOPMENT OF THE IRON AND STEEL INDUSTRY IN THE LESS DEVELOPED COUNTRIES

Josef Hlaváček, Ing., Chief Specialist, State Institute for Designing of Metallurgical Plants, Prague

INTRODUCTION

Steel is and will remain for a long time one of the main needs of our civilisation. In spite of all changes in the development of economics, effected by the application of new techniques, the demand of steel increases, especially in the countries with higly developed industry even when steel is replaced by other materials (other metals or plastics).

The growth of the claim for steel is proportional to the growth of industrial production and was in the West-European countries in the years 1950 to 1959 in accordance to the industrial growth, which amounted to 5.9 % a year. Contrary to this fact, the growth of steel consumption was in U.S.A. in the same period only 0.26 %, whilst the increase of industrial production was 3.5 %. Here the increase of steel consumption was not in accordance to the industrial production in consequence of an other industrial structure.

Generally we may say, that in normal peaceful production programme the covering of economical requirements is in connection with the increase of steel consumption and this production will remain for a long time an index of the rising life standard of the population.

In the East-European Socialist States the increase of steel production is much more rapid than the industrial production and the annual average of the steel increase in the same period was about 10 %.

It is evident, that the growth of steel production is not unlimited. The index of growth will be higher in the countries with a low consumption per capita and lower in the countries with a high consumption.

It may be assumed that the steel consumption per head in technically developed countries will not overpass 1000 kg per year during the next twenty years. Some countries have at present already reached and even overpassed the limit of 500 to 600 kg in the steel consumption per capita.

Regarding the structure of requirements for steel materials it is evident, that the less developed countries will have a different structure in comparison with the more developed countries and they would claim for realization of constructions, which the more developed countries have made long ago. So it could be expected, that they will have relatively greater demands for rails and railway materials, commercial steel and similar products.

1. ANALYSIS OF THE CONSTRUCTION OF THE IRON AND STEEL INDUSTRY IN THE LESS DEVELOPED COUNTRIES

The less developed countries will not be able to realize the complete building u of their states at once, they would be obliged to proceed it in stages. It will not be possible for them to make use of the European method of building, which had the origin in small factories. But it will be a great advantage in the building of their industry, that they could make immediately use of the modern production technology and so overpass the whole evolution period. On the other hand, a great obstacle will be in high production costs. This will be very much

dependent from the capacity of the equipment. In the countries with large developed techniques production units with capacity of several million tons yearly production are at present built, so that it is not possible for each country, even with large developed industry, to build such works. For the manufacture of all kinds of steel materials i.e. commercial bars, rods, sections, rails, sheets, tubes, wires as well as special and high qualities, castings and forgings, the country should produce 18 to 20 million tons of steel ingots a year, The moder n today's high capacity steel mills require such a high steel production. With a production of 500 kg of steel per head and with fulfilment of the other conditions it would be production of a country of 40 million inhabitants.

If we only consider the demands and not the production conditions we draw the conclusion, that the countries with less than 40 million inhabitants cannot during the first stage of their construction build up modern iron and steel plants with full production of all steel products.

Such iron and steel plants could be built by countries having material and technical conditions and over 40 million inhabitants (China, India, Indonesia, Brasil). A large number of the less developed countries have not such a population, even when they possess all the conditions for building up an iron and steel industry. For such countries it will be necessary to group together for the mutual cooperation and to build this industry in the area, where the economical conditions will be most favorable. But it does not mean, that the smaller, technically less developed countries should remain without metallurgical bases.

It could be summerized, that the small, less developed countries must cooperative for the building of their iron and steel industry in order to install the modern integrated iron and steel plants.

Non-integrated iron and steel works can be built for each country in the limits of national needs and possibilities. The erection of the iron and steel industry, especially of integrated type, would mostly be carried out on the seacost or in the area of a navigable river with economical possibilities, except the cases, when a material and technical basis for building such an industry is in inland.

2. MATERIAL-TECHNICAL BASIS

For the decision concerning the building of new iron and steel plants is deciding - the material-technical basis, i.e. raw material, fuel and power basis, economy of transport and available man power.

The raw material basis must be reliably specified about quantity and quality. The same provision should be applied for the fuel basis. Before the construction of integrated iron and steel works (i.e. with blast furnaces, coke plants, steel plants and rolling mills) the following must be determined by the geological research: o r e m i n i n g m e t h o d - if it will be mining in quarries or underground, i r o n c o n t e n t - detailed c h e m i c a l a n a l y s i s - especially content of undesirable elements such as P, S, As, futher content of other additional metals, especially Cr. Mn, Ni and other compounds such as SiO_2, Al_2O_3, CaO etc. - p h y s i c a l p r o p e r t i e s of the ore, whether the ore is easy or uneasy to reduce, lump ore or powder ore, o r e r e s e r v e s etc.

The iron-ore for the modern iron and steel works must be principally concentrated and dressed. The concentrate should not have a lower content of Fe than 60 % with a minimum of SiO_2. Content of P, S, and As must be reducible on minimum. These elements, especially P,

determinate the future technological process. As in a great quantity makes the ore unworkable.

The integrated iron and steel works can be built on a or base with ore reserves for about 50 years. The quantity of the annual mining should not be larger than 1.5 % of reserves.

The fuel base is in the standard technology important for the production of coke for blast furnaces. This coke makes an important item. Natural gas is one of the most important factors, as it can be used for blast furnaces, melting and heating furnaces and as a power resource. Therefore the geological research of natural gas must be also carried out.

A deciding factor for the ore and fuel base is the possibility of economical transport. Here will be deciding if the basis is in the area of a river, railway or road. Thickness of the ore or coal deposits establishes the economy for the construction or the transport ways.

3. UTILIZATION OF THE FUEL AND POWER BASIS

The integrated iron and steel plants must be designed for the minimum of solid consumption. Coke for blast furnaces cannot be at present entirely substituted by liquid or gaseous fuels. Oxygen enriched natural gas or the injection of oil through blast furnace tuyeres will decrease coke consumption in the blast furnace up to 400 kg per ton of pig iron. The U.S.A. and U.S.S.R. using concentrated ores or pellets have at present a consumption of 750 kg per ton of pig iron. This fact will economically influence the location of the metallurgical works. Without the use of natural gas or oil, and without the use of concentrated ores it is necessary to transport 1250 kg of technological coal per ton of pig iron. With the use of natural gas or oil only 670 kg. Natural gas or oil reduce considerably the transport costs and consequently the production costs. The use of natural gas or oil not only in blast furnaces but also in melting and heating furnaces should become a principle in modern iron and steel works. There is an exception if the plant is built on the base of solid fuel.

The use of these fuels will considerably reduce the investment costs because the coke plants could be constructed with smaller capacity and the cost of material handling in the plant will decrease.

If there is an abundance of natural gas or oil a power plant for the production process steam may be constructed with maximum of a third part of electric power.

Application of the natural gas and oil system will not involve special investment. Natural gas can be conducted even for a distance of thousands of kilometres. As the less developed countries are mostly in warm zones the oil system will be less complicated.

As above mentioned, the integrated iron and steel industry could be built with economics with the help of the planned cooperation and division of production schedule by the countries united in pursuing this aim - and thus in stages.

In the first stage of construction it seems to be advantageous to reach for the mutually cooperating countries with small numbe of inhabitants a production of 150 kg of steel per head. The same applies for each independant country with a greater numbre of inhabitants. The countries associated for their mutual economical aid could made a complex of states of 60 to 80 millions and even more inhabitants and should produce in the first stage approximately 12 million tons of steel. This production corresponds to the errection of three modern integrated steel works. These plants should be specialised each for a different

kind of production and each work should be completed by corresponding steel consuming shops. One work should produce sheet coils, other shapes, sections and rails and the third strips, wires and sections. The construction should be realized in the countries with the best economical conditions (raw materials, market). Neither these three integrated plants would be necessary to build simultanously. For their construction to the full capacity it would be pressumed an investment cost of 1.500 - 1.800 million dollars + 45.000 workers.

The building of the I. stage with the setting up of the particular production units to full capacity would last 8 years from the date of the regular placing of the order. It would also be necessary to organize a training of one third workers of all categories in the more developed countries; it would be necessary to staff the key positions during the first 2 - 4 years of running in by cadres from the supplying country.

In the second stage the annual production of 20 million tons of steel should be reached, which would correspondent to the present level in the Polnish People's Democratic Republic. In this stage high quality steel and every kinds of metallurgical production (wires, pipes, rops) could be produced.

New techniques and production processes could be applied to the full extend in these new integrated iron and steel plants.

For the coke production should be used batteries with great volumes, with 30 m^3 chambers, for the pig iron production 2000 m^3 blast furnace: with a burden of 100 % self-fluxing sinter or self-fluxing pellets, with a complete automation in burden preparation and in proper technological process and in power system.

As melting units could be used great volume SM-furnaces with the content of 200 t to 400 t and with oil heating or oxygen converters of 150 to 250 tons. Casting could be produced in ingots up to 24 tons from semi-killed steel and with a raised metal output. For blooming and slabbing mills the most moder electrical equipment with shortest reversing times should be used. In the case of a convenient arrangement of roughing and continuous wide wide strip mills the output possibility could reach up to 5 million tons a year.

It would also be possible to install continuous casting, especially for the production of slabbs and so obtain better economical results.

Rolling mills would be fully automated and would secure the highest quality products with highest productivity.
The capacity of such a rolling mill would overpass annually 1 million tons of finished products.

The mutual cooperating countries could anticipate large cumulation of orders, which would be able to make the best utilization of the production units and in consequence of it to cut the actual production costs.

The integrated plantsas industrial assemblies might even become regional power plants, gas works and material technical bases for futher work out shops, which would, according to the plan, use products of the integrated iron and steel metallurgy. So could be erected in the area of the coke plant a unit for sulphuric acid, for the utilization of chemical byproducts such as tar, phenol, naphtaline and ethylen.

Slag from the blast furnaces could be utilized for the erection of an integrated construction plant.

N o n - i n t e g r a t e d i r o n a n d s t e e l w o r k s have usually scrap as material-technical basis. But they can use

even other row materials, such as lumps or sponge iron. As regards the scrap basis, this will be unsufficient from the own sources in consequence of low consumption of steel in the less developed countries and these countries would be under the necessity to buy the scrap or to produce lumps from the own poor iron ores and these to smelt either in open hearth or electric arc units of furnaces. Such steelworks may have the smelting units up to 100 t capacity and produce 500,000 - 1,000,000 tons of steel a year. In the case, that they possess available sources of cheap electrical power, they will build melting shops with electric arc furnaces, in case of available oil or natural gas, they will build melting shops with with open hearth furnaces.

This conception may advantageously use the continual steel casting process to spare the blooming mill costs and to obtain a higher utilization of steel up to 8 % and also higher economical results of the production.

As regards the non-integrated iron and steel works, the high capacity rolling mills cannot be here considered. As these units have a relative low capacity, they will not produce at such low costs and such a high productivity as the rolling mills in the integrated steelworks. But they will have an other advantage in the fact, that they will easier roll all the coming orders and produce more economically all the small amounts of rolling materials, which will be surely very required. An other advantage of non-integrated works is, that they can produce also special steels.

Investment costs of such a non-intergrated plant with a capacity of 800,000 tons a year would make approximately 70 to 80 million dollars; the need of workers would be about 2500 to 3500 of man power in accordance with the difficulty of the orders to be produced.

These works could be a good workmen school for the large integrated steelworks. The erection time from the date of order to the date of full production would be 5 to 6 years.

4. ANALYSIS OF ERECTION POSSIBILITIES

For the building of the iron and steel industry it must be appreciated that before solving the conception problems there must be made a detailed geological rechearch. The results of this labour must be considered in the general plan of development of the national economy of the country.

For the erection of the integrated iron and steel plants both is absolutely necessary for every country taking part in the mutual economical cooperation. Besides that, it is necessary to build the whole developing plan of mutual cooperation with delimitation and specialization of the production.

This plan must determinate the country in which the industry is to be established and time delimitation of the building up of the individual stages. Based on this general plan of the development a detailed study of the development of the iron and steel industry must be worked out. Project of the individual steel works must be worked out including economical computation in several alternatives of their location. The study must allow for erection in stages, for a possible futur extension of the work and also for a future introduction of new techniques, which cannot be put into reality at the time, when the erection begin.

As soon as one of the alternatives has been choosen it is possible to proceed to a more specific projection work. Czechoslovakia has experiences and in the projection institutes also a sufficient designing capacity for the working out such designs since one

industry plant has been bult and completed on the basis of the project of this institute and the secon one is under construction now. Apart of this a number of reconstructions have been worked out. Needless to say, that this was done with the aid of the industry of Czechoslovakia. Czechoslovakia has his own experiencies with the erection of coke plants, blast furnaces, roll killns for lumps, ore and coal dressing plants, sintering plants, open hearth and arc furnaces, melting shops, some rolling mills especially for sections and strips, founderies, welding and forging shops inclusively power plants.

If the interrested country decides for the establiahment of the non-integrated industry it is not indespensable to link up its development plan with the others countries, interrested in economical cooperation. In this case also the geological survey will not be indespensable.

The erection of non-integrated steelworks would be praktically limited on the building of a steel shop and rolling mill shop with a simple power plant and transpot equipment.

In designing such works it could be relatively soon approached to detailed designs. The whole erection time is here practically three years shoter. Also here can be applied erection in stages from smaller to bigger furnaces. There could be applied also some reconstructed rolling mill equipment, especially in countries with abundance of worker. In the later erection such works can be reconstracted for producing special steels, what must be kept in mind in the designs.

In the developed countries there can be also applied some new proved technological processes as oxygen converters, high capacityfurnaces, heavy ingots, semikilled steels, oxygen, oil, natural gas and automation.

But a contemporary erection of special steel work cannot be advided. Such works must be considered in the third stage, as the special steels lay great claims to technical ability of skilled worker.

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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D.7.1

Czechoslovakia

FACTORS INFLUENCING THE SETTING UP AND DEVELOPMENT OF THE IRON AND STEEL INDUSTRY IN THE LESS DEVELOPED COUNTRIES

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Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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FACTORS INFLUENCING THE SETTING UP AND DEVELOPMENT OF THE IRON AND STEEL INDUSTRY IN THE LESS DEVELOPED COUNTRIES

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SUMMARY

Factors influencing the setting up and development of the iron and steel industry in the less developed countries are the material technical base and the market. This market depends upon the number of inhabitants. A country with few inhabitants cannot build,if it does not intend to export the major part of its production, an integrated iron and steel industry (i.e. with blast furnaces, coke plants, ore dressing plant, steel plants and rolling mills) for all kinds of metallurgical products, as particularly the rolling mills each have a capacity of more than one million tons a year, and sometimes even several million tons per year.

At present with a consumption of 500 kg of steel per head a capacity of 18 to 20 million tons per year would be necessary for the economical production of the whole range of metallurgical products.

The integrated iron and steel industry could be therefore constructed either in the countries with a great number of inhabitants or even in the countries with few inhabitants if these countries have a material technical base and if they decide for economic mutual aid. For the first stage 40 million inhabitants are required. Integrated iron and steel works consider as a minimum a production unit of 4 million tons of steel per year with a raw material base for 50 years at least, and with low-cost transport. The building of such a work would require an investment of 500 to 600 million dollars, 15,000 man power and 8 years to complete the building of the first stage.

The non-integrated metallurgical industry can be established in the less developed countries with a small population on the seacoast or on a navigable river. This industry using lumps, scrap or sponge iron will have an annual capacity of 500,000 to 1,000.000 tons. This capacity could be gained within 5 to 6 years. This plant could include rolling mills for low capacities with a low productivity for small orders and would need 2500 to 3500 employees. Such plant could be erected with the sum of 70 to 80 million dollars.

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Agenda Item: D

Brazil

INDUSTRIAL DEVELOPMENT

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INDUSTRIAL DEVELOPMENT

by

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I - Introduction

1. We shall try a brief analysis, based on our own experience, about the possibilities of setting up a diversified industry, in a country having an economic structure considered under-developed and suffering the impact of inflationary pressures, when such industry is a necessary agent for the correction and suppression of corrupt processes of social and economic stratification.
2. In under-developed areas, the low "per capita" income of thepopulation produces a high propensity to consume and consequently a low level of savings. Thus, the reserves for investments are weakened, and the capitalization index is relatively low.
3. The modest formation of capital, resulting from the large propensity to consume and from the small amount of private savings in under-developed economies, is, in Brazil, aggravated by strong issues of paper-currency, rendering more and more difficult the situation of private enterprises, which are losing ground to public investments in the last years, as can be seen from the statistics of national income (see Annex).
4. The chronic inflation constitutes one of the greatest obstacles to private enterprises, for it creates difficulties to new investment , in view of the uncertain outlook which it produces on future conditions, and makes it impossible for the businessman to accomplish plans which can reasonably be carried out within the budgetary forecasts.
5. Most industries work in a full capacity regime, and, sometimes, with obsolete equipment and technology, due in part to the difficulty of imports, which burdens the production with low productivity, or with high operating costs.
6. Among the classic economists, economic development was a process through which an economy would evolve from a progressive to a stationary condition, in which it would be needed capital replacements and profits would remain constant.
7. By adopting the full-employment thesis, the classic theory admitted that, once the stationary condition was reached, changes could only derive from technological progress.
8. In modern post-Keynesian economic theory, once under-employment is recognized as the normal condition, economic development is defined as the increase of the "per capita" income of a population; for a balanced development, production must grow according to the income elasticity of the economy. The start-up of the movement implies the building of roads and other facilities; there must be coordination among industries producing raw materials, capital goods and consumption goods.
9. The industrialization process planned as an effort for development must rest on strong economic basis. Development is not merely a function of capital expenditures. These will generate future expenses with the use of the capital goods created. Thus, programming of expenditures shall be made simultaneously

with that of production.

10. In general, a policy of industrial development must be based on:

(a). Creation of adequate systems of transportation and generation of electric power, reasonably located, according to the local existence of raw materials and to the proximity of markets.

(b). Improvement, rationality and development of already existent industries, which have real economic possibilities in the region.

(c). Training of skilled technical knowledge and of lower degree manpower, to supply the new industries and also to get better efficiency from traditional industries. The scarcity of qualified labour is a phenomenon similar to the scarcity of capital. When labour is insufficient, it must be used with parsimony, and applied in the bottle-necks of the system. It is necessary to maintain the whole plan within the limits of available manpower, in order to avoid disorder and waste.

(d). Maximum utilization of local raw materials. This initiative will stimulate the exploration of the region, increasing the level of employment through the activity in this primary sector, and will reduce the distances of transportation thus making production cheaper.

(e). Installation of basic industries with high generative characteristics such as petrochemicals and steelmaking. The great importance of these industries is obvious: in a close future, they induce the private enterprises to build correlative and dependent industries. Without the stimulation of the basic industries, the others would never be built.

11. In under-developed economies, infra-structural basic investments introduce higher levels of productivity and create new markets. These investments have a generative power, and this force lies less in the investment itself than in the economic sector into which it is inserted. Besides, a bad choice of sector for an investment application results, as we have seen before, in an unforeseen waste of means, represented by the costs of uneconomic operation of the capital goods created.

12. Since the market exerts the development, only the State is in position to plan and lead the implantation of development. State planning is absolutely essential for a good evolution of the development process, since only through a careful project, prepared with a wide knowledge of all the injunctions and implications of each sector on the others, can economic growth be obtained without high social costs.

13. The extensive Northeastern Region in Brazil, composed of eight states (Piauí, Ceará, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas, Sergipe & Bahia), with 15.7% of the total surface of the country, 31% of its population and 14% of its yearly income, is the greatest problem and challenge for Brazilian Governmental Administration. This serious situation determined a pronounced extent of economic intervention by the Federal Government, to create basic conditions to attract private enterprises, and not only the planning for industrial development but also projects for a necessary agrarian reform are in the hands of the Superintendency for the Development of Northeast (SUDENE).

14. A boom economic growth generally leads to a progressive weakening of agricultural activity, in regard to the rest of economic activities. The proceedings which tend to increase industrial productivity must be followed by others which drive at the increase of demand for industrial goods, and this is not as Say presumed, a direct consequence. We know today that production does not create its own demand, and that demand must proceed from other sectors, especially from the agricultural sector. If capital is applied in industry, and agriculture remains stagnant, the result will be ruinous to the industrial sector itself, in view of the increase of competition within a limited market.

15. Therefore, it is necessary to increase agricultural income in order to create a market for industrial goods.

16. Moreover, it is true that, in countries like Brazil, industrialization depends largely on the development of international trade of agricultural goods, which creates exchange values, vital for imports of equipment, technology and know-how for industry.

17. The start-up of an industrial development process generally forces a recruitment of labour in delayed agricultural sectors, and our experience shows that the productivity obtained in industry by a labour so conscripted is very low. Thus, on one side industrial growth is weakened by the delay of an old agrarian structure, and on the other side the industrial growth weakens agricultural sector, producing an exodus in the fields and making it more difficult to stimulate farmers to increase production. It is a sort of vicious circle, which must be broken somewhere.

18. Uniform economic development requires that agriculture and industry grow together. Obviously this doesn't mean that they must grow at the same rate. The rate of development for each sector will be finally a function of its income elasticity, for a balanced growth.

19. The evolution of Brazilian economic conditions shows a gradual retardation of the agronomical production, with regard to industrial production:

TABLE 1

Indexes of Real and "Per Capita" Products

Years	Real Product			"Per Capita" Product		
	Agriculture	Industry	Total	Agriculture	Industry	Total
1950	103.3	111.8	106.5	100.9	109.2	104.0
1951	104.6	124.0	113.6	99.8	118.3	108.4
1952	112.8	132.4	118.7	105.1	123.4	110.6
1953	112.6	138.4	123.5	102.5	125.9	112.4
1954	122.2	150.0	132.1	108.6	133.3	117.5
1955	129.1	157.6	137.2	112.1	136.9	119.2
1956	127.3	178.4	143.8	108.0	151.3	122.0
1957	140.3	198.8	157.3	116.2	164.7	130.4
1958	141.8	235.1	168.7	114.8	190.4	136.6
1959	151.2	260.6	177.5	119.5	205.9	140.3

20. These indexes are the full demonstration of the progressive delay of agricultural activity in our development process. They make it clear that a big effort must be accomplished in the sector, in order to reconquer the necessary balance, essential to the continuation of industrial development itself.

II - Scale

21. Each type of industry has an "optimum" size, fixed mainly by the market. Of course, if the market is strongly under-supplied, no variation of sales price will occur, with a variation of annual output in the range of contemplated operations. In that case, this particular production would be operating in a typical economic bottleneck, with a big potential market, and the private businessman would be only limited by his investment possibilities. This situation is easily identified in many industrial sectors of under-developed economies, where usually the increase of capitalization is jeopardized by scarcity of investment power and by the uncertainty of budgets, produced by inflation.

22. Of course, when a particular sector is already reasonably supplied, a variation of annual output should be expected, and in such case a market study would be required to indicate the company's share of the total market, at various sales prices.

23. In a fast-growing economy, the extrapolation of a train of data, representing past years, is not always reliable as a method of forecast for future markets. The reason is that under economic conditions suffering a process of expansion, there is a host of exogenous influences which affect the development of markets, making forecasts very complex.

24. In many cases, a potential market is easily identified, making obvious that new investments in the field are destined to be successful.
25. The investigation of markets, and of variation of sales prices with production, when required, is the first big step to fix capacity. The second big step is to calculate investments and cost.
26. The capital investment is divided into two types of capital: the fixed capital, represented by the investments in production, and the working capital, represented by the funds required to conduct business. Of course, investment and cost are functions of installed capacity, but this subject will be discussed later, in paragraphs 40 and 41. In these paragraphs, we must keep our attention directed to the selection of a capacity based upon maximum profitability.
27. The fixed capital estimate is obtained by adding the costs of: purchased equipment, equipment installation, land, buildings, electrical, utilities, engineering, construction and contractor's fee. The working capital would be the sum of raw material inventory, in-process inventory, product inventory, extended credit and available cash.
28. The two mentioned steps have typical characteristics in under-developed ecomies. First, the market investigation must concern all exogenous influences which affect the sector. In Brazil, for instance, if we want to have a forecast of future consumption of liquid fuels, we cannot just extrapolate past data; we must inquire the present aims of recently installed automobile industry, the expansion plans of thermoelectrical power stations, the plans for transformation of steam traction to diesel traction in railways, the expansion projects of merchant marine, etc. Since they are now practically in the beginning of their activities, all these external influences are growing enormously in our country, and their ascendancy over future consumption of fuels is basic. The identification of potencial markets is another imposition in very frequent cases, and it is usually done by confrontation with foreign countries, concerning the development of new markets in regard to "per capita" income of populations, or by a sharp knowledge about the substitution phenomenon in the behaviour of demand.
29. The second big problem for fixing capacities is the investment and cost problem, under an economic conjuncture like ours. Under the existing circumstances, inflation completely subverts all budgets, making the capital surveys unforeseeable.
30. In accordance with official data, indexes of costs in Brazil have been the following, during the last years:

TABLE 2
COST INDEXES
1948 = 100

Year	Construction Materials	Cost of Living	Industrial Products
1944	93	58	83
1945	88	68	90
1946	100	79	101
1947	110	97	99
1948	100	100	100
1949	114	104	105
1950	125	111	109
1951	153	128	129
1952	156	150	139
1953	193	172	160
1954	239	210	211
1955	245	259	240
1956	321	313	298
1957	383	363	349
1958	488	417	408
1959	647	580	587
1960	735	750	724
1961	1052	1000	1031

31. As we see it, inflation is serious in Brazil, and does not encourage private businessmen to assume high financial commitments. Under these conditions, capacities for maximum profitability are not very often attained.
32. We cannot discuss theories on inflation here. The aim of the work is essentially practical. Of course, we could suggest that before an industrial development process is started, reforms should be made in the economic conjuncture of the country, in order to restrain inflation. We could sustain other thesis about many aspects of the problem. But to be objective with regard to the Conference's purposes, and thinking of our own great experience, which is the Northeastern Region, we must point out problems as they appear to us, in practice.
33. We must carry out an industrial development plan, under the detrimental influence of inflation. The demands of developing the capitalization index in Brazilian Northeast Region is undelayable, as it is the only strong way to fight social and economic backwardness, and in a near future it will help extraordinarily to fight the inflation which embarrassed its installation.
34. Market is not a problem, in Brazil. With a vast territory of 3.3 million square miles, and a population of 70 million inhabitants, the low national income leads to a repressed demand avid for new investments. The problem is, therefore, the scarcity of capital. For this reason, honest and generative foreign capital is welcome, and stimulation of national private capital is the great charge of Government.
35. In Brazil, the banking system does not assist yet, as it should, the needs of the economy. It is composed of about 120 principal banks, which cover almost 95% of total financial movement. Beyond this private system of banks, there is the Bank of Brazil, which acts officially as a conventional bank and as a central bank.
36. In order to stimulate generative infra-structural investments, the National Bank of Economical Development was established, in order to manage funds obtained from an additional tax on the income tax, levied on all citizen and artificial persons, and indemnified by federal bonds.
37. The Bank of Northeastern Brazil was founded to take care of that region and applies federal funds as loans to farmers and entrepreneurs established in the area.
38. Briefly, this is the structure of the Brazilian banking system. Inflation produces an enormous expansion of credit, as issues of paper-currency increase bank deposits, and inflation process is much aggravated by this. Since inflation makes money very expensive, large investments to satisfy existent and latent demands may not be possible or economically profitable.
39. Government has, therefore, a great task in stimulating capitalization. Besides all that is done through Federal Banks and local Governments, the Superintendency for the Development of the Northeast (SUDENE) has today, in Brazil, the power to declare which industries can be benefited by a recent decree that authorizes the artificial person, with 100% national capital, a deduction up to 50% of its income tax for application in industries in Northeastern Region; this deduction cannot exceed 50% of the invested amount.
40. Obviously, industrial investments are functions of installed capacities. From a wide series of different observations, it was remarked that, in a first approach, investment varies approximately as the 0.6 power of capacity for that portion of the plant which increases its capacity by employing larger equipment. Investment will vary directly with the capacity for the plant which increases its capacity by using multiple units.

$$\frac{I_1}{I_2} = \left(\frac{C_1}{C_2}\right)^{0.6} \qquad \text{(enlarging equipment)}$$

$$\frac{I_1}{I_2} = \frac{C_1}{C_2} \qquad \text{(multiplying equipment)}$$

41. Therefore, the choice of capacity is dependent upon the availability of investment. After a conservative enquiry of market is made, it may happen that the maximization of profits may not be attained at a maximum capacity, as money becomes more and more expensive with the growth of the investment values, under inflationary economies.

III - Petrochemical Industry

42. It is fundamental that investments made with a direct purpose of developing economically backward areas have highly generative characteristics.

43. In Brazil, there is a big latent market for petrochemicals. It is not very easy to work in an unexplored industrial field; but the great stimulus is the certainty of success, both in its economical and its social results.

44. We have already in the market some petrochmical products, obtained from the steel and from the chemical industry. Thus, there are available supplies of ammonia, ammonia sulfate, benzene, toluene, xylene, styrene, naphthalene, ethylene, butadiene, alcohol, caustic soda, resins, tar, and some others.

45. Modernization of farming and perspectives of a just and unavoidable agrarian reform make probable a rapid increase of fertilizer consumption. A tremendous growth of plastics markets is also certain, and a large potential market of polyester fibers is to be foreseen.

46. Automobile industries caused a big new demand for tyres and increased necessities for synthetic rubber. For the same reason, the use of nylon cords in tyres increased the nylon market.

47. For all these reasons, and many others, development of the petrochemical industry in Brazil is a must and as a basic activity it will have an enormous generative power.

48. Wherever, in any country, for any reasons, Governments have social and economic problems in less developed areas, and a big industrial program of local investments is advisable as a method for increasing "per capita" income and creating new sources of labour, acting through a remarkable multiplier of investments index, it is most advisable to establish the bases for a petrochemical complex.

49. The tremendous growth of the petrochemical industry in the world results from the overall increased demand for chemicals, which cannot be produced in sufficient quantities from other sources. The improvement of refining and cracking techniques due to the necessity of increasing quality and quantity of fuels, increased the quantities of low molecular weight olefines, which are basic raw materials, required by the petrochemical industry.

50. The petrochemical industry has been based primarily on by-product raw materials from the petroleum industry, and its output is growing at a much faster rate than that of refined products.

51. The number of products of this extremely diversified industry is remarkable. The multiplier index of investments in the field is, therefore, very high.

52. In our days, refineries are generally pressed to a run for gasolines with higher and higher octane numbers, as internal combustion engines require fuels with increasing anti-knock characteristics. For automotive gasolines the processes most adopted are the Catalytic Cracking and the Catalytic Reforming units. Both processes, besides producing highly anti-knock compounds, make low molecular weight olefines, as ethylene, propylene, and butylenes, extremely valuable for petrochemical transformations.

53. Catalytic Reforming units usually work in blocked operation, producing high octane gasolines or a blend of aromatic hydrocarbons (benzene, toluene and xylenes). Therefore, the use of aromatics as raw materials to start up a petrochemic industrial complex depends primordially on the existence of a standard refinery, equipped with a Catalytic Reforming unit.

54. The availability of aromatic hydrocarbons would permit the production among others of:

Raw Material		Product
BENZENE	Styrene, phenol, dodecyl-benzene, synthetic fibers, aniline, DDT, maleic-anhydride, benzene-hexachloride, nytro-benzene, etc.	
TOLUENE	Aviation gasoline, motor gasoline, solvents, explosives, plastics, etc	
XYLENE	Solvents, aviation gasoline, phthalic acids, etc.	

55. In Brazil, aromatics imports have been, in Kgs:

TABLE 9

PRODUCT	YEAR 1957	1958	1959
BENZENE	303 564	550 273	478 772
TOLUENE	1 285 887	136 268	778 795
XYLENE	1 832 960	63 106	2 828 227
TOTAL	3 422 411	1 749 647	4 085 794

56. Considering that the value of a raw material is finally a function of the value of its products, we must also estimate indirect imports of aromatics i.e., importation of these hydrocarbons through their imported products; by doing so, we shall have, together with a more conservative estimate of the aromatics market in the country, a clearer idea of the generative force of petrochemical industry.
57. Tables show that markets for aromatics are quite different from the volumes of imports of the pure hydrocarbons. Also, the diversification of imported aromatic products shows large possibilities for the implantation of petrochemical industry, starting from benzene, toluene and xylenes as raw materials.
58. Low molecular weight olefines are easily obtained as by-products of petroleum processing. Thus, ethylene is produced in Catalytic and in Thermal Cracking units. It can be obtained also by dehydration of ethyl alcohol or by hydrogenation of acetylene. Propylene and butylenes are by-products from the cracking of gaseous or liquid hydrocarbons.
59. Chief uses of ethylene:

(a). Chlorination of ethylene produces the dichloroethane, used as an industrial solvent and in the commercial blends of tetra-ethyl lead;

(b). Hydration of ethylene produces the ethyl alcohol;

(c). Oxidation of ethylene produces the ethylene oxide, and intermediate basic compound for ethylene glycol production. Ethylene glycol end-uses are, among others; antifreezes, cellophane, explosives, synthetic fibers, glycol ethers, hydraulic fluids, industrial coolants, etc.;

(d). Polymerization of ethylene produces polyethylene, the most popular among plastics. In the United States, polyethylene consumption exceeds one billion pounds a year;

(e). Alkylation of ethylene with benzene produces the ethylbenzene, and dehydrogenation of ethylbenzene produces styrene, whose chief end-uses are: polystyrene, synthetic rubber, protective coatings, polyester resins, high-impact resins, etc.

60. Chief uses of propylene are:

(a). Chlorination of propylene produces the dichloropropane, used as a solvent. Allyl chloride is another product of propylene chlorination, used as an intermediate compound in production of glycerine and allyl alcohol;

(b). Hydration of propylene produces the isopropyl alcohol, used in acetone manufacture, and as a solvent for oils, gums, shellac and synthetic resins.

(c). Oxidation of propylene produces the ethylene oxide, intermediate compound used in the production of propylene glycol, polyethers and polypropylene glycols.

(d). Polymerization of propylene produces polypropylene which has an outstanding future among propylar plastics.

61. Chief uses of butylenes:

(a). Hydration of normal butylene produces the butyl alcohol secondary, used for making fruit essences, for the manufacture of secondary butyl esters and ketones, or as solvent and thinner in lacquers. Hydration of isobutylene produces

the butyl alcohol tertiary, used in industrial cleaning preparations, in perfumes, and as an extraction and recrystallization solvent;

(b). Dehydrogenation of butylenes produces butadiene, used in synthetic rubber manufacture.

62. Besides the olefines, paraffins can also be used in the petrochemical industry. They can be dehydrogenated to produce olefines, and also several direct uses in organic synthesis.

63. Of course, we have seen only a small fraction of the tremendous possibilities of the petrochemical industry. As the aim of this unpretentious work is to analyse processes for an economic development start-up movement, we have only examined the first stage of this particular industry, as the cited raw materials are directly produced in refineries as by-products. We have tried to show the extraordinary potentialities of the industry to generate new investments, creating wealth and labour in the area.

TABLE 3

IMPORTS OF BENZENE PRODUCTS
1957 to 1959

Product	1957 kg	1958 kg	1959 kg
Nitro Benzene Clorine	138 060	58 000	307 271
Styrene	5 103 494	4 008 453	2 378 377
Dodecyl Benzene	-	377 404	410 069
B H C	1 674 041	254 750	578 047
D D T	1 461 820	1 333 556	196 717
Nitro Benzene	50	-	61
Benzyl Alcohol	12 427	4 758	15 772
Phenylethyl Alcohol	10 166	10 335	10 158
Phenylpropyl Alcohol	32	30	157
Benzoic Aldehyde	6 003	3 928	5 995
Maleic Anhydride	76 334	157 164	92 382
Benzyl Benzoate	8 046	2 715	3 142
Phenyl Salicylate	1 862	710	680
Sodium Benzoate	96 961	64 690	143 296
Benzidine	16 960	5 035	4 020
Phenol	2 041 214	1 717 444	1 868 979
Chlorophenol	117 503	117 921	61 384
Phenothiazine	409 217	70 039	477 108
Phenol Formaldehyde	96 604	37 292	14 093
Nylon	713 046	861 634	278 052
Polystyrene	200	5 729	11 318
Modified Phenolic Resins	-	-	813
Aniline Dyes	1 177 415	1 013 422	1 505 849
Total	13 161 455	10 105 009	8 362 927

T A B L E 4

IMPORTS OF TOLUENE PRODUCTS

1957 to 1959

Product	1957 Kg	1958 Kg	1959 Kg
Benzoic Acid	16 306	29 241	33 280
Toluidine	10 329	15 220	6 073
Total	26 635	44 461	39 439

T A B L E 5

IMPORTS OF XILENES PRODUCTS

1957 to 1959

Product	1957 Kg	1958 Kg	1959 Kg
Phthalic Acid	-	17 345	53 765
Phthalic Anhydride	30 027	23 232	1 020 529
Total	30 027	40 577	1 074 294

TABLE 6

INDIRECT IMPORTATION OF BENZENE

1957 to 1959

Product	Weight % of benzene in the product	Indirectly imported benzene		
		1957	1958	1959
Nitro Benzene Clorine	50 0	68 373	28 724	152 172
Styrene	75 0	3 827 620	3 006 339	1 783 782
Dodecyl Benzene	31 7	—	119 665	130 022
B H C	26 8	448 712	68 283	154 940
D D T	22 0	321 642	293 420	43 283
Nitrobenzene	63 4	32	—	38
Benzyl Alcohol	72 9	9 059	3 468	11 497
Phenylethyl Alcohol	63 9	6 500	6 608	6 494
Phenylpropyl Alcohol	57 4	18	17	90
Benzoic Aldehyde	73 6	4 417	2 890	4 412
Maleic Anhydride	79 5	60 756	125 090	73 528
Benzil Benzoate	73 6	5 921	1 998	2 312
Phenyl Salicylate	78 7	1 467	559	536
Sodium Benzoate	54 1	52 521	35 040	77 619
Benzidine	83 8	14 224	4 223	3 372
Phenol	82 9	1 693 773	1 425 113	1 550 854
Chlorophenol	53 0	62 349	62 570	32 571
Phenothiazine	78 0	319 189	54 630	372 144
Phenol Formaldehyde	75 7	73 156	28 241	10 672
Nylon	36 4	259 986	314 053	101 346
Polystyrene	75 0	150	4 297	8 488
Modified Phenolic Resins	75 7	—	—	616
Aniline Dyes		392 472	337 807	501 950
	Total:	7 622 247	5 923 035	5 022 738

TABLE 7

INDIRECT IMPORTATION OF TOLUENE
1957 to 1959

Product	Weight % of toluene in the product	Indirectly imported Toluene		
		1957	1958	1959
Benzoic Acid	75 4	12 296	22 051	25 096
Benzyl Acetate	61 3	—	—	—
Toluidine	85 9	8 881	13 086	5 222
Total:		21 177	35 137	30 318

TABLE 8

INDIRECT IMPORTATION OF XYLENES
1957 to 1959

Product	Weight % of toluene in the product	Indirectly imported Toluene		
		1957	1958	1959
Phthalic acid	63 8	—	11 076	34 332
Phthalic Anhydride	71 6	21 506	16 639	730 919
Total :		21 506	27 715	765 251

ANNEX
Table 10

BRAZIL

Years	Consumption and Investment — Billions of Cruzeiros — Private Sector — Consumpt. (A)	Invest. (B)	Total (C)	Public Sector — Consumpt. (D)	Invest. (E)	Total (F)	F/C %	F/C Index 1948=100	D/A %	D/A Index 1948=100	E/B %	E/B Index 1948=100	Issues of Paper-currency — In millions of Cr$ — Balance at the end of the year	Annual Variation + or -
1947	125.2	25.1	150.3	16.2	4.0	20.2	13.4	88	12.9	90	15.9	79	20 395	- 94
1948	137.8	25.2	163.0	19.9	5.1	25.0	15.3	100	14.4	100	20.2	100	21 693	+ 1 298
1949	165.1	24.2	189.3	24.6	8.0	32.6	17.2	112	14.9	103	33.1	164	24 042	+ 2 349
1950	194.4	23.2	217.6	29.1	10.1	39.2	18.0	118	15.0	104	43.5	215	31 202	+ 7 160
1951	214.1	48.6	262.7	34.8	10.4	45.2	17.2	112	16.3	113	21.4	106	35 316	+ 7 114
1952	244.8	52.6	297.4	39.9	12.5	52.4	17.6	115	16.3	113	23.8	118	39 280	+ 3 964
1953	320.9	35.8	356.7	57.0	14.3	71.3	20.0	131	17.8	124	39.9	198	47 002	+ 7 722
1954	395.7	62.6	458.3	63.8	19.8	83.6	18.2	119	16.1	112	31.6	156	59 039	+ 12 037
1955	508.8	69.5	578.3	81.3	20.4	101.7	17.6	115	16.0	111	29.4	146	69 340	+ 10 301
1956	649.3	81.4	730.7	114.6	25.1	139.7	19.1	125	17.6	122	30.8	152	80 819	+ 11 479
1957	783.8	84.7	868.5	130.3	39.8	170.1	19.6	128	16.6	115	47.0	233	96 575	+ 15 756
1958	964.1	114.0	1 078.1	151.1	51.6	202.7	18.8	123	15.7	109	45.3	224	119 814	+ 23 239
1959	-	-	-	-	-	-	-	-	-	-	-	-	154 621	+ 34 807

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FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D

Brazil

INDUSTRIAL DEVELOPMENT

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Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

NOTES

1. Papers selected for inclusion in General Sessions will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

2. Papers selected for inclusion in Specialized Sessions will be available at the Conference in only one of the above official languages.

3. Summaries of all papers, as submitted by contributors, will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

4. Papers and summaries will not be available for general distribution in advance of the Conference. They will be published in advance in limited quantities only for the use of delegations of participating governments and of other authorized participants. Post-Conference publication and general distribution of the Conference Proceedings will follow United Nations practices as laid down by the United Nations Publications Board.

INDUSTRIAL DEVELOPMENT

by

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I - INTRODUCTION

In general a policy of industrial development must be based on:

(a). Creation of adequate systems of transportation and generation of electric power;

(b). Improvement, rationality and development of already existent industries;

(c). Training of skilled technical knowledge and of lower degree man-power;

(d). Maximum utilization of local raw materials;

(e). Installation of basic industries with high generative characteristics.

In under-developed economies, infra-structural basic investments introduce higher levels of productivity and create new markets. State planning is absolutely essential for a good evolution of development process, since only through a careful project, prepared with a wide knowledge of all the injunctions and implications of each sector on the others, can economic growth be obtained without high social cost

It is necessary to increase agricultural income in order to create a market for industrial goods. Uniform economic development requires agriculture and industry grow together. If capital is applied in industry and agriculture remains stagnant, the result will be ruinous to the industrial sector itself, in view of the increase of competition within a limited market.

II - SCALE

The investigation of markets, and often of potential markets, and a study of the variation of sale prices with production, when required, is the first big step to fix capacity. The second big step is to calculate investment and cost. The two steps have typical characteristics, in under-developed economies.

In a fast-growing economy, the extrapolation of a train of data, representing past years, is not always reliable as a method of forecast for future markets. The reason is that under economic conditions suffering a process of expansion, there is a host of exogenous influences which affect the development of markets, making forecasts very complex.

The second big problem for fixing capacities is to calculate investment and cost. Under existing circumstances, inflation completely subverts all budgets, making capital surveys unforeseeable. Private businessmen are not encouraged to assume high financial commitments, and, under these conditions, capacities for maximum profitability are not very often attained.

III - PETROCHEMICAL INDUSTRY

It is fundamental that investments made with a direct purpose of developing economically backward areas have generative characteristics.

In Brazil, we have a big latent market for petrochemicals. Modernization of farming and perspectives of a first and unavoidable agrarian reform make probable a rapid increase of fertilizer consumption. A tremendous growth of plastics markets is also certain, and a large potential market of polyester fibers is to be foreseen. Automobile industries caused a big new demand for tyres, and increased necessities for synthetic rubber. For the same reason, the use of nylon cords in tyres increased the nylon market.

The number of products of this extremely diversified industry is remarkable. The multiplier index of investments in the field is, therefore, very high.

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**КОНФЕРЕНЦИЯ ОРГАНИЗАЦИИ ОБЪЕДИНЕННЫХ НАЦИЙ
ПО ВОПРОСУ О ПРИМЕНЕНИИ НАУЧНЫХ И ТЕХНИЧЕСКИХ ЗНАНИЙ
ДЛЯ УДОВЛЕТВОРЕНИЯ ПОТРЕБНОСТЕЙ МЕНЕЕ РАЗВИТЫХ РАЙОНОВ**

ПУНКТ ПОВЕСТКИ ДНЯ: D.1

СССР

ПУТИ И МЕТОДЫ ИНДУСТРИАЛИЗАЦИИ СССР

Составил И. В. МАЕВСКИЙ,
доктор экономических наук.

Документы, составленные для Конференции Организации Объединенных Наций по вопросу о применении научных и технических знаний для удовлетворения потребностей менее развитых районов, служат в качестве рабочих документов для этой Конференции. Они опубликованы в том виде, в каком были представлены их составителями, и их содержимое и выраженные в них мнения принадлежат их составителям (см. примечания на оборотной стороне).

ПРИМЕЧАНИЯ

1. Документы, включенные в число материалов, принятых для обсуждения на общих сессиях, будут в распоряжении делегатов Конференции на следующих официальных языках Организации Объединенных Наций: русском, английском, испанском и французском.

2. Документы, включенные в число материалов, принятых для обсуждения на специализированных сессиях, будут в распоряжении делегатов Конференции только на одном из этих официальных языков.

3. Резюме всех документов в том виде, в каком они были представлены их составителями, будут в распоряжении делегатов Конференции на следующих официальных языках Организации Объединенных Наций: русском, английском, испанском и французском.

4. До открытия Конференции документы и резюме не будут выпущены для общего распространения. Они будут опубликованы заблаговременно только в ограниченном числе экземпляров и исключительно для правительственных делегаций и других правомочных участников. Последующие опубликование и рассылка трудов Конференции будут обеспечены в соответствии с практикой Организации Объединенных Наций, как это установлено ее Издательским комитетом.

ПУТИ И МЕТОДЫ ИНДУСТРИАЛИЗАЦИИ СССР

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Советскому государству, возникшему в результате Великой Октябрьской социалистической революции, необходимо было ликвидировать ту промышленную и общеэкономическую отсталость, которая досталась ему от прошлого. А эта отсталость, дополненная к тому же разорительной империалистической войной и интервенцией, была очень большой.

Дореволюционная Россия была по преимуществу аграрной страной с наличием феодально-крепостнических пережитков. В сельском хозяйстве господствовало мелкое производство, опиравшееся на примитивную технику. В 1913 г. удельный вес промышленной продукции в валовой продукции крупной промышленности и сельского хозяйства составлял 42,1%, а сельскохозяйственной продукции - 57,9%. На долю всей промышленности, строительства, транспорта и связи приходилось всего 11% населения, занятого в народном хозяйстве, а на долю сельского хозяйства - 75%.

Об экономическом отставании России свидетельствовал уровень развития отраслей, производящих орудия производства, которыми хозяйство страны было оснащено в четыре раза хуже Англии, в пять раз хуже Германии, в десять раз хуже Америки. В соответствии с этим производительность труда в промышленности дореволюционной России была ниже, чем в промышленности США примерно в 9 раз, Англии - 4,9, Германии - в 4,7, Франции - 3,3 раза. Технико-экономическая отсталость обусловливала сильную экономическую зависимость России от капиталистических стран Западной Европы .

Социалистическая революция, заменив господство частной собственности на средства производства общественной собственностью, создала политические и материальные предпосылки для перестройки экономики страны на социалистических началах. Переход основных средств производства из рук эксплуататорских классов в руки трудящихся открыл простор развитию производства, вовлечению широких народных масс в управление государственной и хозяйственной жизнью.

Чтобы создать адекватную социализму материально-техническую базу, надо было после восстановления народного хозяйства в наикратчайший срок осуществить социалистическую индустриализацию, превратить страну из аграрной в индустриальную, способную производить своими силами все необходимое для технического перевооружения народного хозяйства, подготовить миллионы квалифицированных кадров рабочих и специалистов.

Проведение социалистической индустриализации в СССР встретилось с исключительными трудностями, вызванными общей экономической отсталостью страны и отсутствием какой бы то ни было материальной помощи извне. Советский Союз вынужден ориентировать-

ся только на свои внутренние ресурсы. Между тем индустриализация требовала огромных капитальных вложений. Само собой разумеется, что захват чужих территорий и эксплуатация трудящихся, несовместимые с природой советского государства, не могли стать источником средств для развития крупной промышленности.

Социалистическая революция создала невиданные ранее по характеру и масштабам источники экономических ресурсов для индустриализации. Национализация крупных промышленных предприятий, земли, транспорта, внешней и внутренней торговли, банков позволили использовать на финансирование индустриализации ту часть национального дохода, которая прежде присваивалась в форме прибылей российскими и иностранными капиталистами, составляла выплату процентов по займам иностранным государствам, шла на паразитическое потребление буржуазии и помещиков. Ликвидировав помещичью собственность, Советская власть освободила крестьянство от арендных платежей помещикам, от расходов на покупку земли и задолженности банкам. Крестьяне, кровно заинтересованные в технической реконструкции не только земледелия, но и всего народного хозяйства, помогли своими средствами в строительстве промышленности.

Однако, главным источником финансирования индустриализации стали внутрипромышленные накопления, объем которых непрерывно увеличивался благодаря повышению рентабельности предприятий и строжайшей экономии в расходах на производство и управление. Важнейшим фактором индустриально-технического развития Советского Союза являлось непрерывное повышение производительности труда. Производительность труда рабочих в промышленности возросла за годы довоенных пятилеток /1928-1940 гг./ в 3,4 раза. Каждый процент роста производительности труда обеспечивал огромное приращение объема годового продукта общества. В первой пятилетке /1928-1932 гг./ один процент роста производительности труда в промышленности давал прирост промышленной продукции на 31 млн. руб., во второй пятилетке /1933-1937 гг./ - на 50 млн. руб., в годы третьей пятилетки /1937-1940 гг./ - больше 100 млн. руб. Повышение производительности труда обеспечивало экономию общественного труда, увеличивало объем промышленного производства при относительно меньших затратах человеческой энергии и материальных средств, а это вело к снижению издержек производства, к расширению фонда накопления и потребления.

Средства государственных и кооперативных предприятий, а также свободные средства населения концентрировались в финансово-кредитной системе, через которую Советская власть распределяла мобилизованные денежные ресурсы между отраслями народного хозяйства, выделяя часть из них в первую очередь для развития тяжелой индустрии.

В процессе социалистической индустриализации создавались квалифицированные кадры рабочих и инженерно-технических работников, удельный вес которых в промышленности, а также на транспорте и в строительстве повышался. В то время как с 1926 по 1939 гг. численность рабочих промышленности увеличилась более чем в 2 раза, количество слесарей возросло в 3,7 раза, сборовых мастеров - в 5,7, токарей - в 6,8, фрезеровщиков - в 15, станочников - в 14, монтеров и электромонтеров - в 6,4, прессовщиков и штамповщиков - в 6,3, инструментальщиков - в 12,3, рабочих-механиков - в 9,5, инженеров - в 7,7 раза. Подготовка квалифицированных и опытных кадров, необходимых для освоения и развития новой техники, велась организованно на заводах, фабриках и в учебных заведениях страны путем подъема общеобразовательного и культурно-тех-

ничесκого уровня народа, причем квалифицированные кадры готовились одновременно со строительством новых крупных промышленных предприятий, что способствовало ускорению темпов ввода в действие дополнительных производственных мощностей промышленности.

Советское государство, направляя усилия трудящихся на осуществление технической реконструкции народного хозяйства, руководствовалось научно-обоснованной программой социалистического преобразования страны, исходило из глубокого анализа объективных экономических законов и конкретной исторической обстановки. Социалистическое обобществление производства позволило планомерно развивать экономику в общегосударственном масштабе, в плановом порядке распределять средства производства и рабочую силу между отраслями народного хозяйства и экономическими районами, сознательно изменять хозяйственные пропорции в соответствии с задачами всемерного развития крупного социалистического производства и улучшения жизни народа.

Учитывая общественные потребности, как производственные, так и личные, Советское государство планировало основные экономические пропорции и, прежде всего, пропорции между производством и потреблением, производством средств производства и производством предметов потребления, между промышленностью и сельским хозяйством, средствами производства и ресурсами труда, пропорции между республиками и районами, производством и транспортом, добиваясь тем самым соразмерности в развитии отдельных отраслей народного хозяйства.

В народнохозяйственных планах Советское государство последовательно проводило линию на преимущественное развитие тяжелой индустрии, без чего невозможно расширять производство быстрыми темпами и технически перевооружить народное хозяйство. Для социалистической индустриализации было характерно первоочередное развитие таких отраслей тяжелой индустрии как электроэнергетика, металлургия, машиностроение, нефтяная, угольная и химическая промышленность.

Ускоренное развитие тяжелой промышленности привело к коренному изменению структуры промышленного производства. Доля производства средств производства в общем объеме продукции промышленности поднялась с 33,3% в 1913 г. до 61,2% в 1940 г. Объем промышленной продукции в 1940 г. по сравнению с 1913 г. возрос в 8,5 раза, в том числе по производству средств производства в 15,5 раза и по производству предметов потребления - в 4,9 раза. Таким образом, одновременно с ростом тяжелой индустрии развивались отрасли легкой и пищевой промышленности, снабжавшие предметами потребления возрастающее городское население и деревню.

Благодаря преимущественному развитию тяжелой промышленности народное хозяйство страны было реконструировано за относительно короткий исторический срок. Уже в 1937 г. удельный вес крупной промышленности в валовой продукции промышленности и сельского хозяйства составил 77,4%. В результате социалистической индустриализации крупное производство в промышленности стало безраздельно господствующим. Удельный вес крупной промышленности в валовой продукции всей промышленности, составлявший в 1913 г. около 03%, поднялся в 1940 г. до 98,2%. В 1940 г. на советских промышленных предприятиях, имевших свыше тысячи рабочих, было сосредоточено 58% всех промышленных рабочих и они выпустили 71% всей промышленной продукции. Крупная социалистическая индуст-

рия стала ведущей силой народного хозяйства. Менее чем полтора десятилетия потребовалось Советскому Союзу для того, чтобы превратить отсталую страну в высокоразвитую индустриальную державу.

Предшествующее развитие социалистического общества в СССР подготовило условия для перехода к развернутому строительству коммунизма. Социалистическая экономика СССР в колоссальных размерах превзошла экономику дореволюционной России. В 1961 г. продукция промышленности Советского Союза превысила уровень 1913 г. в 44 раза, и это несмотря на то, что из четырех с половиной десятилетий существования Советского государства лишь половину времени велось мирное социалистическое строительство, а остальное время приходилось защищать страну от агрессоров и восстанавливать разрушенное ими народное хозяйство. Примерно в 11,9 раза возрос уровень производительности труда в 1961 г. по сравнению с 1913 г.

Огромных размеров достигло производство промышленной продукции. Например, в 1961 г. производство электроэнергии составило 327 млрд. квт.ч., стали - 70,7 млн. т., угля - 510,5 млн. т., тканей всех видов - 6,65 млрд.м², обуви кожаной - 442,4 млн.пар. Социалистические производственные отношения обеспечили невиданные ранее высокие темпы роста всех отраслей промышленности. Если общий объем промышленного производства увеличился в 1961 г. по сравнению с 1940 г. в 9,7 раза, то производство средств производства - в 11,4 раза, а производство предметов потребления - в 8,2 раза. В 1961 г. удельный вес производства средств производства в валовой продукции промышленности достиг 73%. Развитие опережающими темпами отраслей тяжелой промышленности обеспечивает непрерывный технический прогресс и рост производства предметов народного потребления.

Изменение отраслевой структуры народного хозяйства сопровождалось систематической рационализацией территориального размещения промышленности посредством приближения промышленности к источникам сырья, топлива и районам потребления, специализации и комплексного развития хозяйства экономических районов, неуклонного подъема экономики ранее отсталых национальных республик. Развитие крупной промышленности в новых, особенно восточных районах - на Урале, в Сибири, на Дальнем Востоке, на основе вовлечения в хозяйственный оборот их богатейших сырьевых и энергетических ресурсов способствовало расширению промышленного производства и ускорению темпов индустриализации ранее отсталых окраин и страны в целом.

Социалистическая индустриализация сыграла решающую роль в преодолении хозяйственной и культурной отсталости бывших национальных окраин, способствуя переходу к социализму ранее отсталых народов, минуя капиталистическую стадию развития. Неравномерное развитие экономических районов в условиях дореволюционной России привело к резкому разрыву в хозяйственном положении центральных районов и национальных окраин, особенно Кавказа, Средней Азии и Казахстана. Отсталость окраин усугублялась сохранением феодально-родовых отношений, колониальной политикой царизма, тормозившей создание промышленности на их территории, уродовавшей экономическую структуру национальных районов, хищнической эксплуатацией природных богатств. Исторически сложившееся экономическое неравенство служило основой национального неравноправия

и колониального угнетения отсталых народов.

К началу социалистической индустриализации, например, в республиках Средней Азии и Казахстане не было развитой машинной индустрии, а предприятия первичной переработки сельскохозяйственного сырья и разработки наиболее богатых месторождений полезных ископаемых, которыми они располагали, имели слабую техническую базу. В народном хозяйстве национальных окраин еще в большей мере, чем в целом по стране, доминировало сельское хозяйство. В Средней Азии и Казахстане доля занятых в фабрично-заводской промышленности из общего количества лиц в народном хозяйстве не достигала одного процента. Самим ходом развития капитализма и господствовавшей в дореволюционной России системой колониальной эксплуатации эти районы были превращены в аграрно-сырьевые придатки метрополии.

Перестройка экономики отсталых национальных республик Советского Союза заключалась в переходе к социалистическому хозяйству, основанному на крупной машинной индустрии. Исходная экономическая база окраин не могла дать сколько-нибудь достаточных накоплений для развернутого промышленного строительства. Поэтому создание промышленности здесь опиралось на всестороннюю и длительную помощь развитых в индустриальном отношении центральных районов.

Правительство СССР направляло в республики разнообразные машины и оборудование, металлы, продукцию химической промышленности, сырье и материалы для промышленности, транспорта и сельского хозяйства.. На предприятиях и в учебных заведениях центральных областей готовились квалифицированные кадры для промышленности Средней Азии и Казахстана. В ходе непрерывного расширения масштабов промышленного строительства и ввода в действие новых предприятий в национальных республиках возрастала потребность в рабочей силе, особенно квалифицированных кадрах.

Социалистическая индустриализация обеспечила полную занятость трудоспособного населения республик, широкое вовлечение в работу промышленности населения местных национальностей. Из центральных районов страны и Украины пополнялись квалифицированными рабочими и специалистами среднеазиатская и казахстанская промышленность. Планомерное перемещение трудовых ресурсов способствовало сближению индустриальных уровней республики. Именно благодаря финансовой и материальной поддержке, оказываемой центральными районами СССР, национальные республики Советского Востока смогли совершить непосредственный переход от докапиталистических отношений к социализму.

Через общесоюзный государственный бюджет, аккумулирующий значительную часть национального дохода и являющийся основным финансовым планом социалистического государства, осуществлялось территориальное перераспределение денежных ресурсов в целях всемерного подъема экономики и культуры ранее отсталых республик. Советская Конституция наделила национальные республики бюджетной самостоятельностью в пределах народнохозяйственного плана. Главная задача в финансировании индустриализации национальных республик возлагалась на союзный бюджет, за счет средств которого финансировалось строительство крупных промышленных предприятий на их территории. При сохранении ведущей роли союзного бюджета в распределении и перераспределении денежных ресурсов в общегосударственных интересах, расширились бюджетные права респуб-

лик, их самостоятельность в использовании бюджетных ресурсов.

Благодаря последовательной демократизации бюджетной системы СССР, передаче большого количества предприятий в республиканское подчинение, укреплению республиканских бюджетов и широкой финансовой и материальной помощи союзного правительства в хозяйственном и культурном развитии неуклонно возрастал объем государственных бюджетов союзных республик, причем особенно быстро увеличивались бюджеты ранее отсталых республик. Так за 1940-1960 гг. бюджетные расходы на народное хозяйство СССР в целом возросли в 2,5 раза, в том числе Узбекской ССР - 17,9, Казахской ССР - в 52,9, Киргизской ССР - в 21,2, Таджикской ССР - в 11,7, Туркменской ССР - в 16,1 раза. Такое резкое увеличение расходов на финансирование народного хозяйства среднеазиатских республик и Казахстана являлось результатом перераспределения средств, поступавших в союзный бюджет в интересах более быстрого индустриального развития ранее отсталых национальных республик.

Эти же принципы лежали в основе территориального распределения средств на капитальное строительство, являющихся источником расширенного воспроизводства. Планомерное перераспределение капиталовложений между высокоразвитыми индустриальными районами и национальными окраинами позволило быстро поднять экономику последних и эффективно использовать людские ресурсы и естественные богатства. Если капиталовложения в народное хозяйство в 1960 г. по сравнению с 1940 г. увеличились в целом по СССР в 3,4 раза, то в Казахстане - в 9,9, в Узбекистане - в 4, в Киргизии - в 3,6, в Таджикистане - в 3 раза. Капиталовложения перераспределялись в пользу более отсталых республик. Проводимая политика капиталовложений обеспечивала высокие темпы роста промышленного производства национальных республик.

Непосредственным итогом огромных капиталовложений в народное хозяйство явилось расширение их индустриальной базы. За годы советской власти в Казахской ССР и республиках Средней Азии построены тысячи крупных промышленных предприятий: в Узбекистане - 1500, в Казахстане - более 2000, в Киргизии - более 700, в Таджикистане - более 300 предприятий. В результате продукция крупной промышленности этих республик возросла за период с 1913 г. по 1960 г. более чем в 60 раз. Промышленность Узбекистана производит в течение 18 дней, в Киргизии - за одну неделю столько промышленной продукции, сколько до революции производилось за целый год. В Казахстане и Средней Азии производится более 20 млрд. квт.ч. электроэнергии, что превышает производство электроэнергии во всей дореволюционной России в 10 раз; в Киргизии выпускается в 1,5 раза больше металлорежущих станков, а добыча угля в одной лишь Казахской ССР теперь выше, чем во всей России в 1913 г.

Советское государство последовательно проводит политику подтягивания экономики отсталых районов до уровня передовых промышленных районов страны. Темпы роста ряда отраслей промышленности в республиках Средней Азии и Казахстана выше, чем в среднем по стране. В 1960 г. по сравнению с 1940 г. добыча угля в республиках Средней Азии и Казахстана увеличилась почти в 5 раз, а в целом по СССР - в 3,1 раза, нефти соответственно - в 9,7, и в 4,6 раза, производство электроэнергии в Казахстане - в 10, в Средней Азии - в 12,9, по СССР - в 6,6 раза, стали в Средней Азии - в 29,2 и по СССР - в 3,6 раза. Темпы индустриального развития устанавливались таким образом, чтобы быстрее ликвидировать разрыв между промышленно развитыми и бывшими аграрными районами страны. Причем про-

мышленное строительство проводилось с учетом экономических, природных и национальных условий в каждой республике.

В результате ускоренной индустриализации отсталых в прошлом национальных республик коренным образом изменилась их роль в общесоюзном разделении труда. Если до революции из Средней Азии и Казахстана вывозились сельскохозяйственное сырье и продукты первичной их переработки /хлопок - волокно/, то теперь, наряду с сырьем эти республики вывозят широкий ассортимент промышленной продукции: сельскохозяйственные, текстильные и другие машины, электротехническое оборудование, цветные металлы, минеральные удобрения, текстильные, швейные, обувные товары, пищевые продукты /растительное масло, консервы и др./.

Индустриальное развитие республик идет по линии непрерывного расширения состава отраслей, комплексного развития хозяйства и совершенствования его структуры. В настоящее время в Средней Азии и Казахстане насчитывается свыше 70 отраслей добывающей и обрабатывающей промышленности, в том числе машиностроительная промышленность, которая имеет заводы, производящие оборудование для радиотехнической, электротехнической и тяжелой промышленности, станки, кузнечно-прессовое оборудование, экскаваторы, сельскохозяйственные машины. Создаваемые предприятия все полнее обеспечивали потребности хозяйства в средствах производства и населения в предметах потребления.

Быстро развивающаяся промышленность республик Средней Азии и Казахстана опирается на собственные природные ресурсы, широкое использование которых определяет специализацию и в значительной мере темпы роста производства. От степени использования естественных богатств зависит участие республик в общесоюзном разделении труда. По некоторым видам промышленной продукции ранее отсталые Средняя Азия и Казахстан занимают выдающееся место в общесоюзном производстве. Так, например, Казахская ССР занимает среди союзных республик первое место по выпуску многих видов цветных металлов, третье место по добыче угля и по производству электроэнергии, республики Средней Азии дают три четверти общесоюзного производства прядильных машин и почти 100% машин для сева, возделывания и уборки хлопчатника. При определении специализации республик рационально сочетались интересы страны в целом с нуждами и потребностями каждой республики.

Уровень промышленного производства отдельных отраслей в Казахстане и Средней Азии выше, чем в ряде капиталистических стран. В Казахстане производится на душу населения примерно столько же промышленной продукции, сколько в Италии; железной руды столько же, сколько в США и намного больше, чем в Англии и ФРГ; угля добывается в 1,5 раза больше, чем в США и в 2,5 раза больше, чем во Франции; производится электроэнергии почти столько же, сколько в Японии и больше чем в Италии. Советские среднеазиатские республики и Казахская ССР производят на душу населения в десятки раз больше электроэнергии, чем такие соседние с ними государства, как Турция, Иран, Пакистан и другие азиатские страны. По добыче угля, выплавке металла, выпуску машин, минеральных удобрений, тканей и пищевых продуктов Казахстан значительно опережает многие страны Востока.

В результате социалистической индустриализации страны и осуществления ленинской национальной политики республики Средней Азии и Казахстан превратились в мощные индустриально-аграрные

районы, пройдя за небольшой исторический период путь, для преодоления которого при капитализме им понадобилось бы многие десятилетия. Такие достижения стали возможны благодаря творческому сотрудничеству и взаимопомощи между всеми народами многонационального Советского Союза, которые составляют отличительную особенность как социалистической индустриализации, так и вообще экономического и культурного строительства при социализме. Промышленность национальных республик будет и впредь развиваться как неотъемлемая часть единой экономики СССР по пути технического прогресса.

Коммунистическая партия Советского Союза на XXII съезде приняла свою третью Программу - программу построения коммунистического общества, основу которой составляет генеральный перспективный план развития экономики и культуры страны, рассчитанный на двадцатилетие /1961-1980 гг./.

Главной экономической задачей партии и Советского народа является создание материально-технической базы коммунизма, что означает: полную электрификацию страны и совершенствование на этой основе техники, технологии и организации общественного производства во всех отраслях народного хозяйства; комплексную механизацию производственных процессов, все более полную их автоматизацию; широкое применение химии в народном хозяйстве; всемерное развитие новых экономически эффективных отраслей производства, новых видов энергии и материалов; всестороннее и рациональное использование природных, материальных и трудовых ресурсов; органическое соединение науки с производством и быстрые темпы научно-технического прогресса; высокий культурно-технический уровень трудящихся; значительное превосходство над наиболее развитыми капиталистическими странами по производительности труда, что составляет важнейшую черту коммунистического общества. Создание материально-технической базы коммунизма обеспечит изобилие материальных и культурных благ для всего населения и постепенный переход к осуществлению принципа распределения по потребностям.

В ближайшее десятилетие /1961-1970 г.г./ СССР превзойдет по производству продукции на душу населения наиболее мощную и богатую страну капитализма - США, в течение 20 лет увеличит объем промышленной продукции не менее, чем в 6 раз и оставит далеко позади нынешний общий объем промышленного производства не только в США, но и будет производить почти в два раза больше промышленной продукции, чем ныне производится во всем капиталистическом мире. Через двадцать лет производительность труда в промышленности СССР возрастет в 4 - 4,5 раза. В Советском Союзе вырастут невиданные по могуществу производительные силы, которые все больше будут обращаться на всестороннее удовлетворение потребностей народа, и будет создан самый высокий в мире жизненный уровень.

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WAYS AND METHODS EMPLOYED IN THE INDUSTRIALISATION OF THE SOVIET UNION

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NOTES

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WAYS AND METHODS EMPLOYED IN THE INDUSTRIALISATION OF THE SOVIET UNION

By I.V.Mayevsky, D.Sc.

Born of the Great October 1917 Socialist Revolution, the Soviet state inherited an extremely backward economy from the past. Industrially underdeveloped, pre-revolutionary Russia was mainly an agrarian country in which the survivals of serfdom and feudalism still existed. Small-scale production based on primitive implements was predominant in agriculture. In 1913 industry accounted for 42.1 per cent, and agriculture for 57.9 per cent of the aggregate industrial and agricultural output of the country. The technical and economic backwardness made Russia greatly dependent on the West-European capitalist powers.

The economic rehabilitation completed, it was necessary to accomplish, within the shortest possible period, socialist industrialisation of the country in order to build an adequate material and technical basis for socialism. Hence, the country was to be transformed from an agrarian into an industrial one capable of fully meeting the needs of the technical reconstruction of the national economy, and training millions of qualified workers and specialists.

The Socialist Revolution opened up new sources of investments, unprecendented in origin and scale. Nationalisation of big industrial enterprises, transport, land, foreign and home trade and banks -- all this made it possible to channel into industrialisation the part of the national income which had previously gone as profits to the Russian and foreign capitalist, interest on foreign loans and parasitic existence of the bourgeoisie and the landlords. As a result of the abolition of private landlord ownership by Soviet power, the peasants had no longer to pay rent to the landlords, to spend money on the purchase of land or to pay debts to the banks. The peasants, vitally interested in the technical reconstruction of agriculture and the national economy as a whole, contributed their own funds to the development of industry. Accumulations within industry became the chief source of investments for industrialisation. The volume of these accumulations was steadily mounting due to the growing productivity of labour and strict economy in production and management.

Socialisation of the means of production allowed planned economic development on a nation-wide scale, planned distribution of the means of production and labour force among the branches of the national economy and economic regions, as well as changes in the economic proportions in accordance with the tasks of a maximum development of socialist production and improvement of the people's living standards. In striving for a balanced development of different branches of the economy, the Soviet state took into consideration the requirements of both production and the public in establishing the main economic proportions, and first and foremost, proportions between production and consumption, the production of the means of production and the production of consumer goods, between industry and agriculture, the means of production and labour resources, between republics and regions, production and transport.

The national economic development plans of the Soviet state consistently provided for the priority development of heavy industry without which the rapid expansion of production and technical re-equipment of the national economy were unthinkable. The national economic reconstruction was completed within a short period. Already in 1937 large-scale industry accounted for 77.4 per cent of the aggregate industrial and agricultural output. As a result of socialist industrialisation, large-scale industry became dominant in the country. Socialist industrialisation was carried out between 1926 and 1937. Henceforth the Soviet Union has been developing as an industrial power.

The distinctive features of socialist industrialisation were determined by the specific historical situation and concrete conditions which prevailed in the country. Having neither experience in socialist industrialisation nor any economic aid from the outside, the Soviet Union nevertheless solved the problem of investments by using its internal resources. This inevitably gave rise to great difficulties in organising large-scale industrial production. Also characteristic of Soviet industrialisation was the development, within a brief historic period, of all branches of heavy industry necessary for the technical reconstruction of all branches of the national economy and the achievement of economic independence.

Socialist industrialisation was carried out in a multinational country whose peoples were at different stages of economic development and many of them had bypassed the stage of capitalism. Accordingly, the economic development of the national regions proceeded with due account being taken of economic, natural and national features of each republic; this enabled the Soviet state to determine rates and proportions of economic development of the national regions as well as the structure of industry and production.

Within a historically short period the republics of Soviet Central Asia and Kazakhstan turned into developed industrial and agricultural regions thanks to socialist industrialisation and the Leninist national policy. Such achievements became possible owing to the creative co-operation and mutual assistance of all the peoples of the multinational Soviet Union, which are characteristic of socialist industrialisation as well as of economic and cultural development under socialism in general. The industry of each national republic will continue to develop as an integral part of the Soviet economy, marching along the path of technical progress.

The preceding development of socialist society in the Soviet Union has paved the way for the all-round construction of communism in the country. The socialist economy of the Soviet Union has immensely surpassed the economy of old Russia. The 1961 industrial output of the Soviet Union was 44 times greater than in 1913.

The Communist Party of the Soviet Union adopted at the 22nd Congress its third Programme -- the Programme of the construction of communist society -- based on the general long-term plan of economic and cultural development for the coming twenty years (1961-80). Within twenty years the Soviet Union will increase the volume of industrial output by at least 6 times. The Soviet Union will build up unprecedentedly powerful productive forces which will be used to an ever growing degree to cover the entire range of public requirements, and world's highest standard of living will thus be achieved.

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